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Indian Standard

DIMENSIONS OF TOROIDAL STRIP-WOUND CORES OF MAGNETICALLY SOFT MATERIAL

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

April 1980

AMENDMENT NO. 1 APRIL 1999
TO
IS 9344 : 1979 DIMENSIONS OF TOROIDAL STRIP-WOUND CORES OF MAGNETICALLY SOFT MATERIAL

(*Page* 3, *Foreword, clause* **0.2**) — Substitute the following for the existing clause:

"**0.2** This standard is largely based on IEC 635 (1978) 'Toroidal strip-wound cores made of magnetically soft material', issued by International Electrotechnical Commission (IEC)."

(*Page* 4, *Table* 1, *col* 2, *first line*) — Substitute 'C22' *for* 'C 2 2'.

(*Page* 4, *Table* 1, *col* 3, *penultimate line*) — Substitute '47-50 percent' *for* '48-50 percent'.

(LTD 13)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 MAY 2002
TO
IS 9344 : 1979 DIMENSIONS OF TOROIDAL STRIP-WOUND CORES OF MAGNETICALLY SOFT MATERIAL

[This amendment is largely based on Amendment 1(1997) to IEC 60635(1978) issued by the International Electrotechnical Commission(IEC).]

(*Page* 5, *Table* 2) — Substitute the following for the existing table:

Table 2 Strip Thickness and Stacking Factor

(*Clause* 4.2)

Nominal Strip Thickness mm	Nominal Stacking Factor (α)	
	Nickel Iron and Cobalt Iron Alloys	Oriented Silicon Steel
(1)	(2)	3)
0.27 - 0.35	0.95	0.95
0.23	—	0.94
0.20	0.93	—
0.15	0.92	—
0.10	0.90	0.92
0.05	0 .85	0.88
0.025(0.030)	0.80	0.82
0..015	0.70	—
0.01	0.62	—
0.006	0.50	—
0.003	0.35	—

NOTE — In the case of thick material 0.27 to 0.35 mm a range of thickness has been given because several grades of material are produced in different thickness.

(LTD 13)

Indian Standard

DIMENSIONS OF TOROIDAL STRIP-WOUND CORES OF MAGNETICALLY SOFT MATERIAL

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Indian Standard

DIMENSIONS OF TOROIDAL STRIP-WOUND CORES OF MAGNETICALLY SOFT MATERIAL

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 31 October 1979, after the draft finalized by the Magnetic Components and Ferrite Materials Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 While preparing this standard assistance has been derived from IEC Doc 51 (Central Office) 186 'Toroidal strip-wound cores of magnetically soft materials', issued by International Electrotechnical Commission (IEC).

0.3 Some guidelines for protection of toroidal strip-wound cores are given in Appendix A for information.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies dimensional and constructional characteristics for toroidal cores wound from strips of magnetically soft steel or alloy having a thickness between 0·003 and 0·35 mm.

1.1.1 It includes standard ranges of main dimensions, values for strip thickness, marking and packing.

1.2 It does not cover dimensions of toroidal cores made from magnetic oxides or ferromagnetic powder which are given in IS : 7930-1976†.

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*Rules for rounding off numerical values (*revised*).

†Dimensions of toroids made of magnetic oxides or iron powder.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions, in addition to those given in IS : 1885 (Part XXXI)-1971*, shall apply.

2.1 Toroidal Strip-Wound Core — A strip-wound core of circular shape.

2.2 Stacking Factor (α) — The ratio of the metal cross section to the total built-up cross section.

NOTE — The terms lamination factor or space factor are sometimes used instead of stacking factor.

2.3 Plain Core — A core of magnetic steel or alloy strip, as wound and thermally treated, but without additional protection.

3. DIMENSIONAL CHARACTERISTICS

3.1 The dimensions of toroidal strip-wound cores are shown in Fig. 1.

4. MATERIALS AND STRIP THICKNESSES

4.1 Toroidal strip-wound cores may be produced from magnetic steel or alloy grouped in Table 1.

TABLE 1 MAGNETIC STEEL AND ALLOYS USED FOR TOROIDAL STRIP-WOUND CORES

MATERIAL	DESIGNATION	APPROXIMATE COMPOSITION IN ADDITION TO IRON
(1)	(2)	(3)
Oriented silicon steel	C2·2	3 percent silicon
Nickel iron alloys	E1	72-83 percent nickel
	E2	54-68 percent nickel
	E3	45-50 percent nickel oriented non-oriented
	E4	35-40 percent nickel
Cobalt iron alloys	F1	48-50 percent cobalt isotropic/anisotropic

4.2 Nominal thicknesses and stacking factors for the material groups of Table 1 are given in Table 2.

---

*Electrotechnical vocabulary: Part XXXI Magnetism.

TABLE 2 STRIP THICKNESS AND STACKING FACTOR

(*Clause* 4.2)

NOMINAL STRIP THICKNESS	NOMINAL STACKING FACTOR (α)	
mm	Nickel Iron and Cobalt Iron Alloys	Oriented Silicon Steel
(1)	(2)	(3)
0·27-0·35	0·95	0·95
0·20	0·93	—
0·15	0·92	—
0·10	0·90	0·92
0·05	0·85	0·88
0·025 (0·030)	0·80	0·82
0·015	0·70	—
0·01	0·62	—
0·006	0·50	—
0·003	0·35	—

NOTE — In the case of thick material 0·27 to 0·35 mm a range of thickness has been given because several grades of material are produced in different thicknesses.

5. WIDTHS OF STRIPS

5.1 The core height is primarily governed by strip width. The preferred values of strip widths are given below:

1·0, 1·5, 2, 3, 4, 5, 6, 8, 10, 12·5, 15, 20, 25, 30 mm.

NOTE — Larger or smaller strip widths may be based on R 10 or R 20 numbers.

6. CORE SIZES

6.1 Standard ratios of outside to inside diameter are given in Table 3.

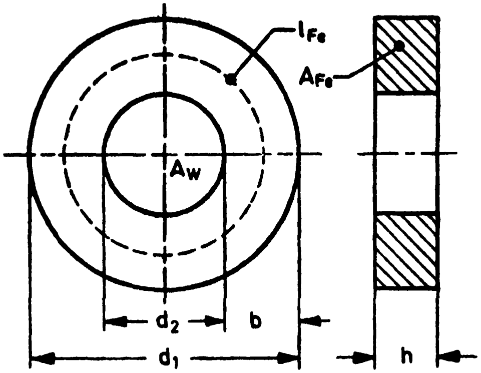
It is recommended that for each diameter ratio, the ratio of the height to inner diameter is approximately as indicated in Table 3.

6.2 The standard outside diameters are given below:

2·5, 3·2, 4, 5, 6·3, 8, 10, 12·5, 16, 20, 25, 32, 40, 50, 63, 80, 100 mm.

NOTE — Larger diameters should be based on numbers from R 10 or R 20 series.

6.3 Cores with ratio of inside diameter d_2 to strip thickness of less than 100 are not recommended.



d_1 = outside diameter of the core
d_2 = inside diameter of the core
h = height of the core (governed by the strip width)
b = build-up of the core; $b = \frac{d_1 - d_2}{2}$
A_{Fe} = cross-sectional area of the magnetic material; $A_{Fe} = b.\ h.\ \alpha$
l_{Fe} = magnetic path length calculated as the arithmetic mean; $l_{Fe} = \frac{d_1 + d_2}{2}.\ \pi$
V_{Fe} = core volume; $V_{Fe} = A_{Fe}.\ l_{Fe}$
m_{Fe} = core mass; $m_{Fe} = \rho.\ V_{Fe}$
ρ = density of the magnetic material

A_W = window area; $A_W = \frac{d_2^2.\ \pi}{4}$

NOTE 1 — In IS : 7616-1974* accurate formulae for the effective area A_e and the effective path length l_e of a solid toroid are given.

For strip-wound toroids,

$A_{Fe} = \alpha\ A_e$
$l_{Fe} = l_e$

NOTE 2 — A more useful formula for A_W having regard to winding practice is given by:

$$A_W = \frac{\pi}{4} (d_2^2 - d_0^2)$$

where d_0 = inner diameter of the coil wound on the core.

This is only correct for plain cores. For protected cores, d_2 is replaced by the value of inside diameter of the protective coating or box.

FIG. 1 DIMENSIONS OF TOROIDAL STRIP-WOUND CORES

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*Guide for calculation of the effective parameters of magnetic piece parts.

TABLE 3 STANDARD RATIOS

(*Clause* 6.1)

d_1/d_2	1·25	1·6	2
h/d_2	0·25 or 0·5	0·3 or 0·6	0·5 or 1

NOTE — Ratio $d_1/d_2 = 1·1$ is also acceptable for cores with $d_1 < 10$ mm.

6.4 The complete standard ranges are given in Table 4.

TABLE 4 STANDARD RANGES

d_1	$d_1/d_2 = 1·25$			$d_1/d_2 = 1·6$			$d_1/d_2 = 2$		
	d_2	h		d_2	h		d_2	h	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2·5	2	—	1	—	—	—	—	—	—
3·2	2·5	—	1·5	2	—	1	—	—	—
4	3·2	—	1·5	2·5	—	1·5	2	1	2
5	4	1	2	3·2	1	2	2·5	1·5	2
6·3	5	1·5	2	4	1	2	3·2	1·5	3
8	6·3	1·5	3	5	1·5	3	4	2	4
10	8	2	4	6·3	2	4	5	2	5
12·5	10	2	5	8	2	5	6·3	3	6
16	12·5	3	6	10	3	6	8	4	8
20	16	4	8	12·5	4	8	10	5	10
25	20	5	10	16	5	10	12·5	6	12·5
32	25	6	12·5	20	6	12·5	16	8	15
40	32	8	15	25	8	15	20	10	20
50	40	10	20	32	10	20	25	12·5	25
63	50	12·5	25	40	12·5	25	30	15	30
80	63	15	30	50	15	30	40	20	—
100	80	20	—	63	20	—	50	25	—

7. PACKING AND MARKING

7.1 Packaging — The cores shall be packed for transit in such a manner as to be adequately protected from mechanical damage.

7.2 Marking — All packages shall be marked with the following:

a) Manufacturer's name or trade-mark;
b) Type and grade of material;
c) Core dimensions (d_1, d_2, h and strip thickness);
d) Quantity; and
e) Manufacturer's batch identification or date of manufacture.

7.2.1 The package may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(*Clause* 0.3)

GUIDELINES FOR PROTECTION

A-0. GENERAL

A-0.1 The core may be protected against damage during transport and by winding in one of the following ways.

A-1. COATED CORE

A-1.1 The plain core is protected by an insulating material, such as epoxy resin, usually applied by dipping or brushing.

A-2. BOXED CORE

A-2.1 The plain core is sealed in a close-fitting annular box of plastic, aluminium or another material. In the case of metal boxes, precaution shall be taken to avoid any short circuit turn effects.

A-3. BOBBIN CORE

A-3.1 The core is wound on a bobbin, usually ceramic or of stainless steel, which undergoes with the core the complete treatment. Usually the bobbin is closed by a non-conducting cap or sleeve after the complete processing of the core.

NOTE — Cores having an outside diameter smaller than 10 mm shall preferably be constructed as bobbin cores.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m²
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m²

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Printed at Printograph, New Delhi, India